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None

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(54) Abstract Title
Securing a pressure regulator to a fuel rail

(57) The fuel rail (2) has an end portion (18) provided with a socket (24) in which is received an inlet tube (16) of the pressure regulator (4) comprising a body bounded by a circumferential flange (12) the body longitudinal axis being substantially normal to the the fuel rail axis. The external surface of the fuel rail is provided with ridge means (22) adjacent to the end portion which carries the socket, and the pressure regulator is secured to the fuel rail by a clip (6) comprising a resilient flange-clasping portion (8) spaced apart from a plurality of resilient arms (10) that are located over the ridge means (22) and which grip the fuel rail (2).

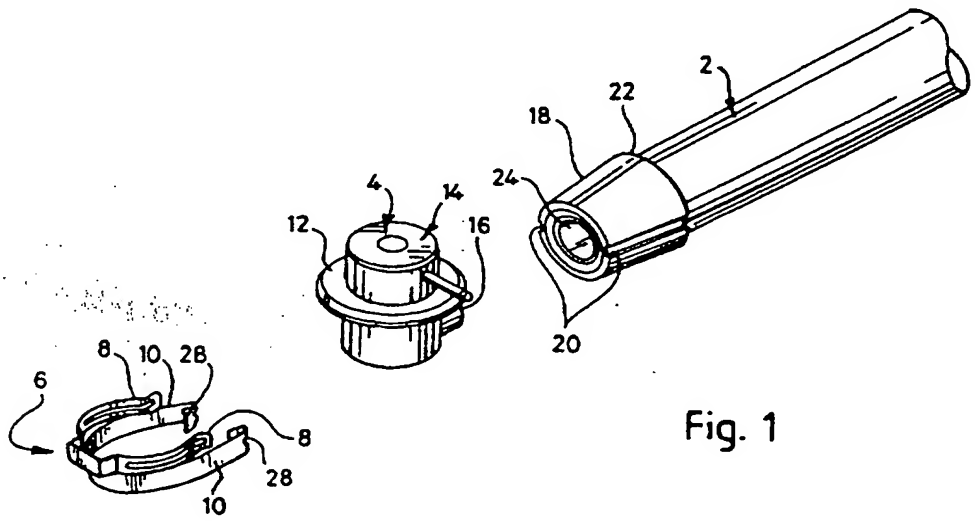

Fig. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

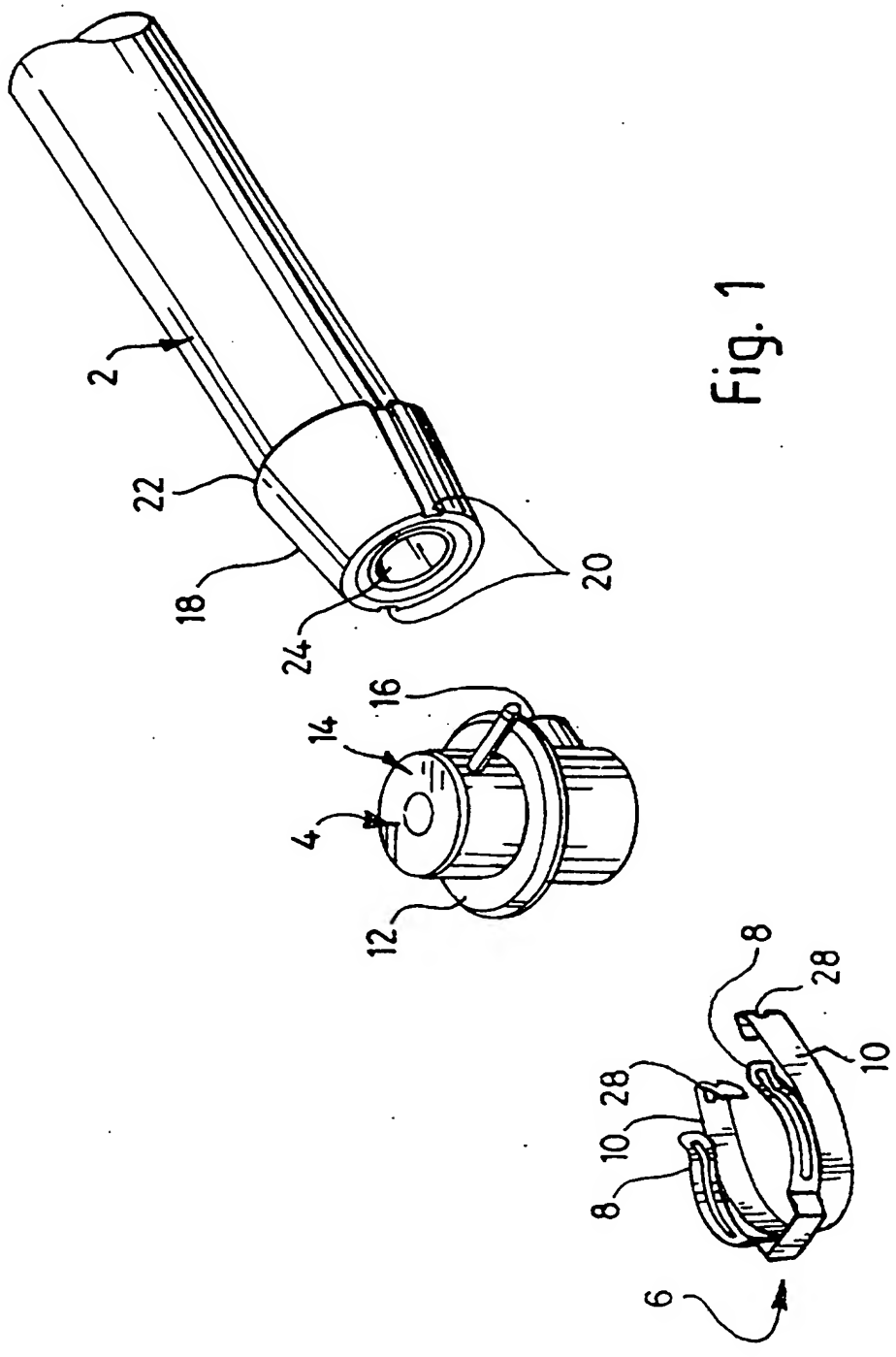

Fig. 1

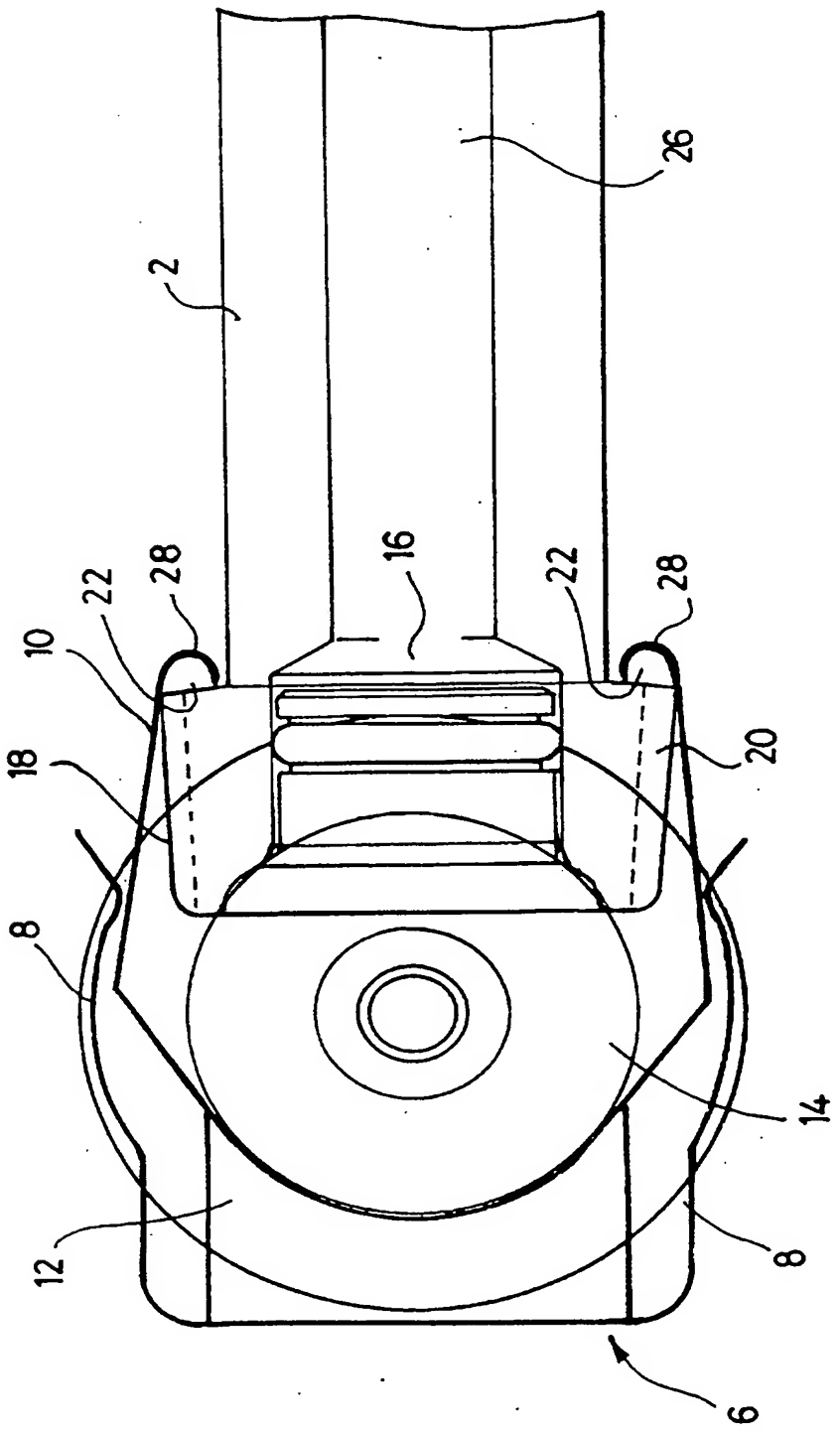

Fig. 2

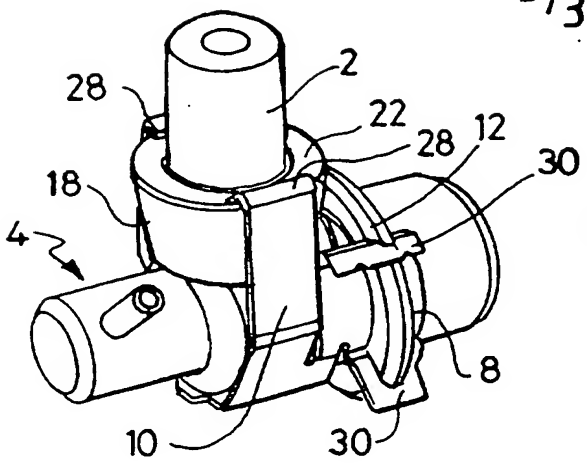

Fig. 3

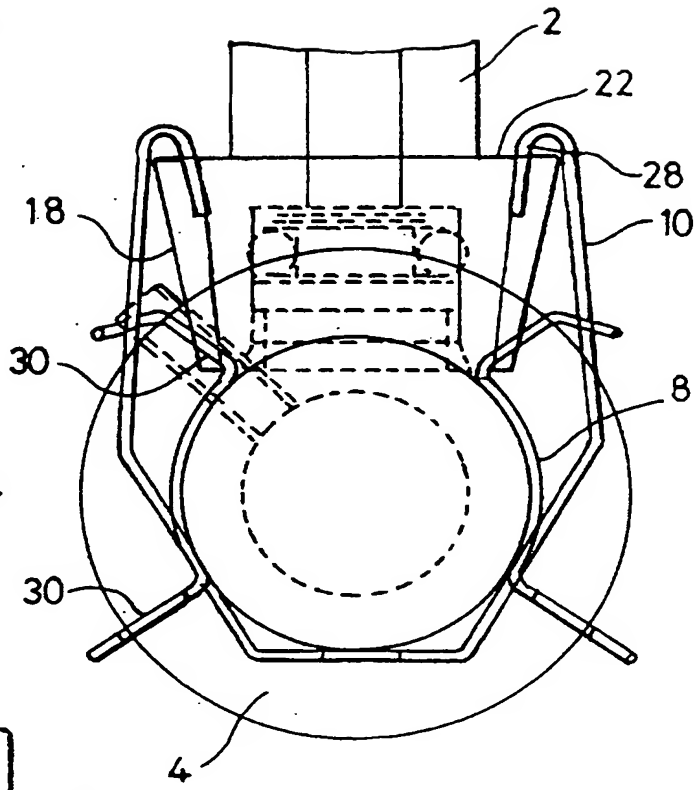

Fig. 4

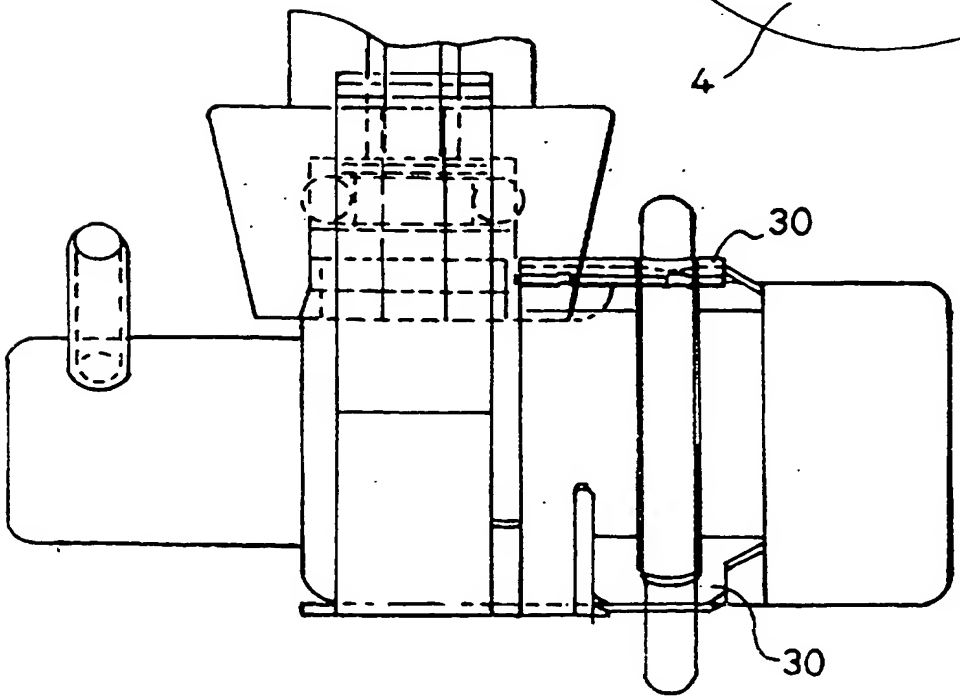

Fig. 5

SECURING A PRESSURE REGULATOR TO A FUEL RAIL

The present invention relates to a device for securing a pressure regulator to a fuel rail of an internal combustion engine, and to a fuel rail assembly incorporating the device.

A fuel pressure regulator is typically secured in a socket in a fuel rail by bolts. The regulator and the fuel rail are each provided with a flange, the flanges being engaging together when the regulator is correctly located in the socket of the fuel rail. Bolts are then used to secure the regulator to the fuel rail through drilled and tapped threads machined in the flanges. This arrangement is relatively complex, requiring the formation of drilled and tapped flanges, and assembly is time consuming.

It has been proposed, in US Patent No. 5 146 896, to secure a pressure regulator in the socket of a fuel rail by forming the fuel rail with a pair of opposed elongate lateral slots in its outer wall. When a pressure regulator having a cylindrical body and a circumferential flange is mounted in the socket of the fuel rail, a clip is used to secure the regulator and the fuel rail together. The clip comprises a pair of spring fingers connected to a pair of tines. The spring fingers grip the pressure regulator and the tines locate in the lateral slots. The clip cannot be pre-assembled with the regulator or the fuel rail.

According to an aspect of the present invention, there is provided an internal combustion engine fuel rail assembly comprising a fuel rail having an end portion provided with a socket in which is received an inlet

tube of a pressure regulator, the pressure regulator having a body bounded by a circumferential flange, the body having a longitudinal axis substantially normal to the longitudinal axis of the fuel rail, the external surface of the fuel rail being provided with ridge means adjacent to the end portion which carries the socket, wherein the pressure regulator is secured to the fuel rail by a clip comprising a resilient flange-clasping portion spaced apart from a plurality of resilient arms that are located over the ridge means and which grip the fuel rail.

The clip can be pre-assembled to the pressure regulator by locating the flange-clasping portion around the flange of the pressure regulator. This sub-assembly can then readily be secured to the fuel rail by pushing the inlet tube into the socket of the fuel rail so that the resilient arms of the clip locate over the ridge means on the fuel rail.

The invention reduces assembly time by providing a snap-fit assembly, rather than using bolts to secure two flanges together.

Because the flange is clasped by the clip, the pressure regulator resists axial vibration down its body.

In a preferred embodiment, the flange-clasping portion is provided with circumferentially spaced apart reinforcing members which span the flange when the assembly is assembled. The reinforcing members help make the assembly more robust and resistant to vibration in use.

The ridge means may comprise a single circumferential

groove around some or all of the fuel rail, or a plurality of indents or depressions. Alternatively, the end of the fuel rail which carries the socket could be profiled so that at least some of the external surface has a larger radius than an adjacent region inboard of the end. The junction of the larger radius portion and the smaller radius portion provides a shoulder on which the resilient arms of the clip can be retained, optionally by means of a claw on the end of each arm.

The clip preferably has two resilient arms which locate on opposite sides of the fuel rail. However, it would be possible to provide more than two arms.

To guide the arms of the clip to the ridge means, longitudinal grooves may be provided on the external surface of the fuel rail.

Another aspect of the invention provides a clip for securing a pressure regulator to a fuel rail, the pressure regulator bounded by a circumferential flange, and an inlet tube depending radially from the body, the fuel rail having a socket for receiving the inlet tube and an external surface provided with ridge means adjacent to the end portion which carries the socket, the said clip comprising a resilient flange-clasping portion spaced apart from a plurality of resilient arms.

The flange-clasping portion may comprise a pair of resilient clasping members.

It is preferred that the flange-clasping portion and the resilient arms are each disposed in substantially

parallel planes.

To provide additional support around the body of the pressure regulator, a portion of the resilient arms may be shaped so as to grip the body when the arms are located on the ridge means. For ease of manufacture, the body of the pressure regulator is preferably substantially cylindrical.

The members of the clip are preferably resilient by virtue of their being formed from spring metal, notably spring steel. However their resilience could also be achieved by other means, for example by means of separate springs to bias the members.

The invention will now be further described, by way of example, with reference to the following drawing in which:

Figure 1 is a perspective view of the components of a fuel rail assembly of a first embodiment of the present invention, prior to assembly;

Figure 2 is a part sectional plan view of the assembled components shown in Figure 1;

Figure 3 is a perspective view of a fuel rail assembly of a second embodiment of the invention;

Figure 4 is a part x-ray plan view of the assembly shown in Figure 3; and

Figure 5 is a part x-ray elevation view of the assembly shown in Figure 3.

The components of the assembly shown in Figures 1 and 2 comprise a fuel rail 2, a pressure regulator 4, and a clip 6. The fuel rail 2 is provided with a profiled end 18 which surrounds a socket 24. The profiled end 18 terminates in a circumferential shoulder 22 inboard of the end of the socket 24. The profiled end 18 is provided with a pair of grooves 20 on opposite sides.

The pressure regulator 4 comprises a cylindrical body 14 bounded by a circumferential flange 12. An inlet pipe 16, for insertion in the socket 24, depends from the body 14.

The clip 6, formed from spring metal, has a flange-clasping portion comprising a pair of clasping members 8, and a pair of resilient arms 10. Each arm 10 is provided with a claw 28, which will be located over the shoulder 22 on the fuel rail 2 when the components are assembled.

To assemble the components, the clasping members 8 are pushed onto the flange 12 to form a sub-assembly in which the arms 10 span the body 14 of the pressure regulator 4. The inlet pipe 16 is then brought to the socket 24, with the claws 28 located in the grooves 20 in the fuel rail end profile 18. Once located correctly, the inlet pipe 16 of the sub-assembly is pushed into the socket 24. This action opens up the resilient arms 10 until the inlet pipe 16 is fully inserted into the socket 24. At this point, the resilient arms 10 snap shut and the claws 28 are releasably retained behind the shoulder 22. This secures the clip 6 to the fuel rail 2, providing a simple and effective method of semi-permanent affixation of the pressure regulator to the fuel rail.

Figures 3 to 5 show a similar assembly to that of Figures 1 and 2, and equivalent parts have been given the same numbers. The shoulder 22 is recessed into the profiled end 18, and the claws 28 are located in the recess to provide a more secure attachment of the clip. The flange-clasping portion 8 is provided with circumferentially spaced apart reinforcing members 30 to make the assembly more robust and able to resist vibration when in use.

The components of the invention can be quickly and easily assembled, without the need for bolts or a mechanised torque gun. The sub-assembly may be assembled at any convenient time prior to completion of the assembly process.

CLAIMS

1. An internal combustion engine fuel rail assembly comprising a fuel rail having an end portion provided with a socket in which is received an inlet tube of a pressure regulator, the pressure regulator having a body bounded by a circumferential flange, the body having a longitudinal axis substantially normal to the longitudinal axis of the fuel rail, the external surface of the fuel rail being provided with ridge means adjacent to the end portion which carries the socket, wherein the pressure regulator is secured to the fuel rail by a clip comprising a resilient flange-clasping portion spaced apart from a plurality of resilient arms that are located over the ridge means and which grip the fuel rail.

2. An assembly as claimed in claim 1, wherein the ridge means comprises a shoulder on a profiled region of the fuel rail.

3. An assembly as claimed in claim 1 or claim 2, wherein the ridge means is radially symmetrical.

4. An assembly as claimed in any one of the preceding claims, wherein the clip has two resilient arms which are located on opposite sides of the fuel rail.

5. An assembly as claimed in any one of the preceding claims, wherein longitudinal grooves are provided on the external surface of the fuel rail to guide the resilient arms of the clip.

6. An assembly as claimed in any one of the preceding claims, wherein each resilient arm is provided with a

claw which locates in a recess of the ridge means when the assembly is assembled.

7. An assembly as claimed in any one of the preceding claims, wherein the flange clasping portion is provided with a plurality of circumferentially spaced apart reinforcing members each of which spans the flange when the assembly is assembled.

8. An internal combustion engine fuel rail assembly substantially as herein described with reference to or as shown in the drawing.

9. A clip for securing a pressure regulator to a fuel rail, the pressure regulator bounded by a circumferential flange, and an inlet tube depending radially from the body, the fuel rail having a socket for receiving the inlet tube and an external surface provided with ridge means adjacent to the end portion which carries the socket, the said clip comprising a resilient flange-clasping portion spaced apart from a plurality of resilient arms.

10. A clip as claimed in claim 9, wherein the flange-clasping portion and the resilient arms are each disposed in substantially parallel planes.

11. A clip for securing a pressure regulator to a fuel rail, the pressure regulator bounded by a circumferential flange, and an inlet tube depending radially from the body, the fuel rail having a socket for receiving the inlet tube and an external surface provided with ridge means adjacent to the end portion which carries the socket, the clip being substantially as herein described with reference to or as shown in

the drawing.

The Patent Office

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Application No:	GB 9812401.9	**Examiner:**	Roger Binding
Claims searched:	1-11	**Date of search:**	20 August 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2G (G7); E2A

Int Cl (Ed.6): F16L 37/00, 41/00, 41/08, 41/12; F02M 69/46; F16B 7/00, 7/04

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	NONE	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.